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SHORT REPORT
Outbreak of *Streptococcus pyogenes* infection in healthcare workers in a paediatric intensive care unit: transmission from a single patient

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SUMMARY

A 15-h stay in a paediatric intensive care unit by a girl with generalized dermal lesions superinfected with *Streptococcus pyogenes* led to four streptococcal infections in healthcare workers. Phenotypic and molecular analyses of the strains revealed that four isolates, characterized as *emm*87/ST62/T28, were identical to the isolate obtained from the index case. The occurrence of this outbreak, despite of the girl's brief hospital stay and appropriate patient management, highlights the high transmissibility of this pathogen.

Key words: Hospital-acquired (nosocomial) infections, *Streptococcus pyogenes*.

Streptococcus pyogenes colonizes the human throat and skin and is primarily transmitted through droplets or direct contact with throat secretions or dermal lesions in infected patients. In the past, *S. pyogenes* was a frequent cause of epidemic outbreaks. Although outbreaks outside the familial setting have markedly decreased in frequency and magnitude, they continue to occur, especially in closed communities such as daycare centres or military units [1, 2]. Nosocomial *S. pyogenes* transmission has been also well documented and, although most reports describe transmission from asymptomatic healthcare workers (HCWs) to patients [3–5], transmission from patients to HCWs has also been described [6–8]. Paediatric intensive care units (PICUs) are a recent creation where hygiene standards are high, explaining why, with some exceptions [9], no *S. pyogenes* outbreaks have hitherto been described in these units. Procedures involving close contact with the patient, such as intubation and resuscitation, are critical elements that favour the transmission of microorganisms from patient to HCW and vice versa.

We describe here an outbreak of *S. pyogenes* affecting HCWs working in a PICU who attended a girl with epidermolysis bullosa and *S. pyogenes* and *Staphylococcus aureus* superinfection. The PICU of Donostia University Hospital has seven beds and 291 children were admitted in 2010.

A 2-month-old girl attended the Paediatric Emergency Department (ED) of Donostia University Hospital where she stayed for 2 h. The girl had been diagnosed at birth with epidermolysis bullosa. On presenting to the paediatric ED, the girl showed poor general health status with hypothermia, vomiting,

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diarrhoea, 15% weight loss and blisters in distinct stages in generalized distribution. The girl was immediately admitted to the PICU and required orotracheal intubation, closed system mechanical ventilation, fluid therapy, transfusion of blood products and intravenous antibiotic therapy (amoxicillin-clavulanate). The clinical course was unfavourable with multiorgan failure 15 h after admission, leading to death. *S. pyogenes* and *S. aureus* were isolated from the admission blood culture. Both pathogens were sensitive to the antibiotic administered.

After the first case of symptomatic pharyngitis due to *S. pyogenes* was detected in a nurse who had been in contact with the index case, active surveillance of possible contacts in the emergency department (ED) and PICU was carried out. In all eligible individuals, a pharyngeal swab was screened for *S. pyogenes*. Twenty-seven individuals considered as possible contacts were investigated. Due to their distinct exposure opportunities, these individuals were divided into three groups. Group A: four PICU HCWs with close contact with the index case who performed intubation and resuscitation procedures; group B: 17 HCWs with sporadic contact (eight were from the PICU and nine were from the ED); and group C: six persons who had no direct contact with the index case but who had contact with persons in close contact with this case.

Standard (hand hygiene, gloving, gowning, device and laundry handling precautions) and contact and respiratory precautions were followed, although a single patient room was not used.

Nasopharyngeal swabs were cultured on 5% sheep blood agar in 10% CO_2 at 37 °C for 24–48 h. Beta-haemolytic, bacitracin-susceptible colonies agglutinating with group A streptococcus antisera (Slidex Strepto-kit; bioMérieux, France) were considered to be *S. pyogenes*. Strain characterization was performed by *emm*-typing (http://www.cdc.gov/ncidod/biotech/strep/M-ProteinGene_typing.htm), multilocus sequence typing (MLST; http://spyogenes.mlst.net), T-typing and pulsed-field gel electrophoresis (PFGE), digesting PFGE inserts with *Sma*I [10].

In view of the bacteriological result of the index case blood culture (24 h after her admission) and the presence of pharyngitis in a nurse (48–54 h after the index case's admission), the investigation for the *S. pyogenes* infection was started with the child's possible contacts described earlier (groups A, B, C). *S. pyogenes* was isolated from five HCWs [four HCWs in the PICU (risk group A) and in one HCW in the paediatric ED (risk group B)]. All infected contacts developed pharyngitis symptoms. Onset of symptoms occurred in the first 48 h in three HCWs, at 3 days in a fourth, and at 7 days in the HCW from the ED. All five symptomatic HCWs were treated with penicillin for 10 days (most of them with amoxicillin 500 mg/12 h). No new cases of streptococcal infection were documented in HCWs in the following 6 months and the outbreak was considered extinguished. Phenotypic and molecular characterization of *S. pyogenes* (*emm*-typing, MLST and T-typing) revealed that four of the five strains isolated from the HCWs were identical to that isolated from the index case: *S. pyogenes emm*87/ST62/T28 with the same PFGE pattern. The *S. pyogenes* strain isolated from the fifth HCW from the ED had a distinct *emm*-type, ST and T-type (*emm*89/ST101/T3, B3264) and a different PFGE pattern (Fig. 1).

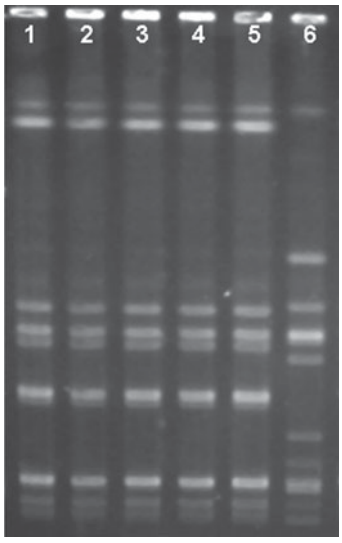

Fig. 1. Pulsed-field gel electrophoresis patterns found in *S. pyogenes* isolates. Lanes 1–5 represent the pattern of *emm*87/ST62/T28 isolates (line 1 the index patient, lines 2–5 the paediatric intensive-care unit healthcare workers); lane 6 represents the pattern of *emm*89/ST101/T3, B3264 isolate of the emergency department worker.

S. pyogenes is highly prevalent worldwide. This pathogen is a frequent cause of pharyngitis and can cause severe disease such as necrotizing fasciitis and streptococcal septic shock. The index case of the outbreak described here was produced after superinfection of the girl's epidermolysis bullosa lesions with *S. pyogenes* and *Staphylococcus aureus*. Pharyngeal transmission in untreated individuals usually lasts 10–21 days, although transmission can last weeks or even months in persons with untreated purulent discharge.

The girl passed quickly through the paediatric ED and stayed only 15 h in the PICU. Antibiotic treatment, to which *S. pyogenes* was sensitive, was started immediately on her arrival at the hospital. Despite the girl's brief hospital stay and appropriate patient management with adequate dermal and respiratory hygiene measures, four HCWs were infected. There were no asymptomatic infections, probably because the infecting dose transmitted by the patient was very high. The high transmissibility of *S. pyogenes* has been shown by the frequent occurrence of secondary cases detected in asymptomatic individuals [3–5], who probably have an infecting dose or bacterial load far lower than that of persons with symptomatic infection. The fifth HCW, with a distinct *S. pyogenes* strain than that detected in the index case, probably acquired the infection in the paediatric ED where she worked. Recent advances in molecular techniques have allowed complete characterization of strains, thus permitting confirmation of the four cases and exclusion of the fifth.

Epidemic outbreaks in infants and children admitted to the PICU are not uncommon but are usually caused by nosocomial bacteria such as *Serratia*, *Pseudomonas*, *Staphylococcus aureus* or viruses. To our knowledge, no outbreak of *S. pyogenes* in a PICU has previously been reported, although we believe such outbreaks are likely given the admission of patients with widespread dermal lesions infected with this highly contagious microorganism. The description of this outbreak highlights the need for HCWs, especially those working in emergency settings, to adhere to strict prevention practices.

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DECLARATION OF INTEREST

None.

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